

cross-bars passing through the stirrups, as in the aqueduct, and prevented from yielding sideways, by the diagonal braces exhibited at A, B, &c. Fig. IV. After which, the whole may be covered with plates of iron, foiled and gravelled, or planked, and covered with earth and gravel in like manner.

Although, I conceive, there is little doubt but a bridge, as above described, would stand to the length of two or three hundred feet, yet the multiplicity of pieces of which it is composed, in order to preserve the shape of the segment and relieve the butments, would evidently occasion much labour and nicety of workmanship; therefore it exhibits the importance of simplifying such works, in order to facilitate their formation, and apply every particle of materials, so that they may tend to strengthen the whole, and not be liable to alter the position.

I shall therefore return to the first proposal of adequate butments, to resist the longitudinal pressure of an arch of any dimensions. In this it must be considered, that the butments need not be of the immense size which first strikes the imagination; for whatever dimensions an arch of iron or wood may be, the quantity of materials is easily calculated, and the weight which the butments will have to resist; for instance, if an arch weighs five hundred tons, and the butments opposed to its pressure weighs one thousand tons, they consequently cannot move, not to mention the weight of earth backing, which tends to render them more permanent; therefore, seeing that the foundations are secured, and the springs, if any, well drained, in order to keep them dry, I see no difficulty in constructing butments to support an arch of any dimensions, and that at much less expence than butments and piers could be erected for a stone bridge; in the same situation particularly,

larly, if such piers were to be built in water of any considerable depth.

Having premised the butments to be of sufficient strength, I consider the arch, whether it be composed of iron or wood, to be like the segment of a hoghead, and the component parts as near as possible like the staves: for this purpose, in constructing one of iron, Fig. VIII. represents two staves, each of which might be cast in open sand, four feet broad from twelve to fifteen feet long, the pattern being formed to the radius of the spring, a flange on the lower side of the staff should be cast, about one foot broad, with holes to receive the screw pins; across the staff one or more ribs, if thought necessary, should be cast, to give strength to the top plate; these ribs and flanges, in uniting the staves would butt on each other, and ultimately compose a rib to the whole extent of the bridge.

Having cast the staves as wide and long as experience may hereafter prove expedient, I will suppose it necessary to erect a bridge one hundred feet span, as in Fig. V.; in building the butments, it would be adviseable to place two or three segments, of the same radius, as the bridge, in each butment, they being cast with arms, or united to binders, in order to take a firm hold on the masonry, and become a permanent support; the segment thus passing into the butments, might be considered as a part of the arch, which, by this means, would butt against the centre of the whole weight of the butment, and must push the whole away before the arch could yield; but, without this precaution, the arch would rest so near the top of the butment, as to raise the stone-work and endanger the whole. Having thus prepared the butments, a centre of three or more segments, so that each staff may have two bearings, should be

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